

Sponsoring Societies

AIAA	IIE
ASQ/RD	SAE
ASQ/E&CD	SOLE
IEEE/RS	SRE
IST	SSS

Participating Organizations

Agere Systems
Air Force Research Laboratory
ALSTOM Transportation, Inc.
Anderson Consulting Co.
ARINC
BAE SYSTEMS
Black and Decker Inc.
Caterpillar, Inc.
DaimlerChrysler AG
DoD PM-MEP
Drexel University
Dynamics Research Corp.
Enron Energy Services
Evans Associates
Ford Motor Co.
General Motors Corp.
Hong Kong Polytechnic Univ.
IBM Corp.
IIT Research Institute
IPS Group, Inc.
James Madison Univ.
Landis Gardner, a UNOVA Co.
Lockheed-Martin
NASA
Northrop Grumman IT
P&W Space Propulsion
Qwest Communications Int'l, Inc.
Radian, Inc.
Raytheon Company
Raytheon Technical Services Company
Rel-Tech Group
SAIC
SBC Services, Inc.
Scien-Tech Assoc, Inc.
Telcordia Technologies
Texas A&M Univ.
The Dow Chemical Co.
US Army CECOM
US Army PM-Soldier Systems
US Military Academy
United Space Alliance
Univ. of Arkansas
Univ. of South Carolina
Univ. of South Florida
Univ. of Washington
Virginia Tech
Visteon Automotive Systems
Xerox Corp.

2002 RAMS Exhibitors

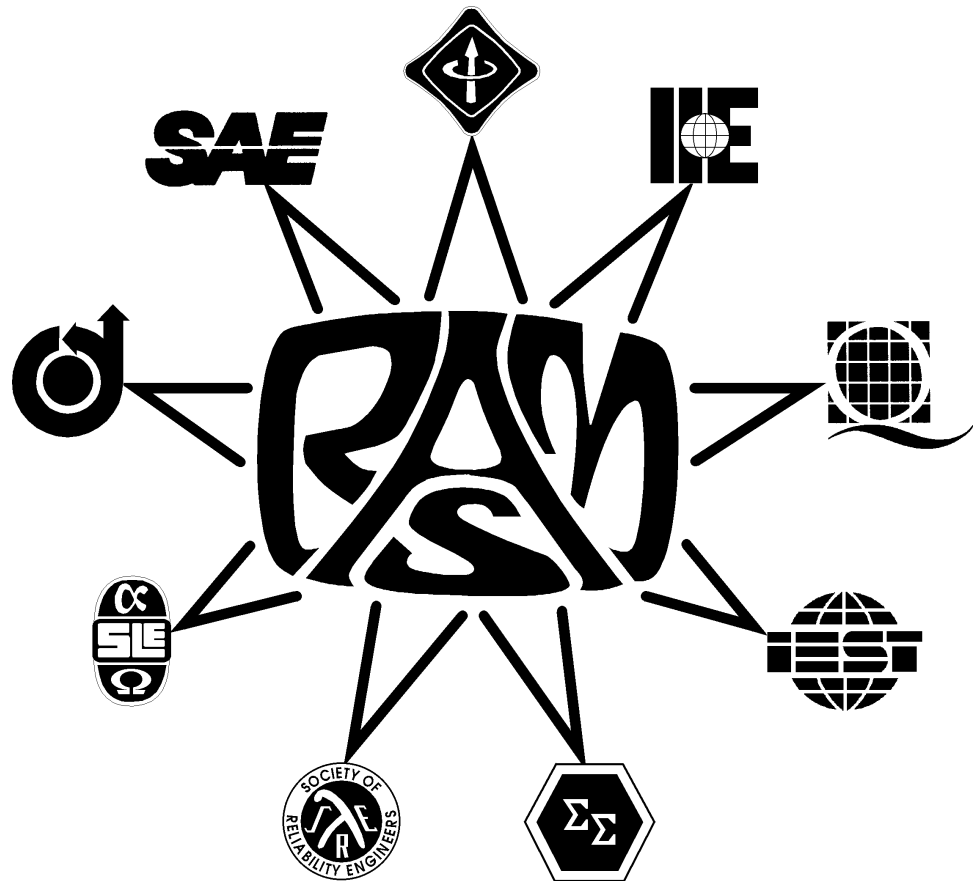
ABS Consulting
ARINC
BQR Relification Software, Ltd
Clockwork Solutions
Data Systems & Solutions
Fulton Findings™
GIDEP
IIT Research Institute/Reliability Analysis Center
Independent Design Analyses, Inc.
Isograph, Inc
Item Software (USA), Inc.
Relex Software Corporation
ReliaSoft Corporation
The Omnicon Group, Inc.

An Invitation To:

The International Symposium on Product Quality & Integrity

Web: <http://www.rams.org>

OUR 48th YEAR



January 28 - 31, 2002
The Westin Seattle
1900 Fifth Avenue
Seattle, WA 98101 USA
1-206-728-1000
1-800-WESTIN-1
Fax 1-206-727-5896

**IMPROVING PRODUCTS AND PROCESSES
THROUGH EDUCATION**

General Chairperson's Message



Lynwood Rabon

Welcome to the 48th Annual International Symposium on Product Quality and Integrity – The Reliability and Maintainability Symposium (RAMS). RAMS is by far the premier event for the assurance professional. It is supported and managed by a volunteer committee composed of assurance technology professionals working in industry, academia and government.

This year's theme, *Beyond 2001 – The Reliability and Maintainability Odyssey Continues*, highlights the increasing rate of change in technology and the challenge this presents to assurance technology professionals. Numerous new assurance tools and processes are developed every year, and our *Symposium* offers a forum for academia, public, and private enterprise users to review and evaluate their long-term value. Successes in the field are presented in paper sessions and debated in panel discussions. Exhibitors are also available to demonstrate electronic reliability and maintainability tools available on the market. The program brochure provides a comprehensive listing of tutorial and panel sessions planned

this year. The *RAMS Discipline Tracks* will be quite useful in determining areas for your interest. Remember, the tutorials qualify for Continuing Education Unit (CEU) credit.

As in previous years, RAMS in cooperation with the American Society for Quality (ASQ), will provide attendees the opportunity to take the ASQ Certified Reliability Engineer examination with a significant discount off the normal examination fee. The exam will be offered on Thursday, the last day of the *Symposium*. Advanced registration is strongly encouraged, with registrations being accepted through Wednesday January 30th on a space available basis.

Please take this opportunity to mark your calendar and save money by registering early for this year's *Symposium*. The opportunity to network literally across the world with the assurance technology elite and discuss the newest tools and techniques available is not possible at any other symposium or workshop. This year we have a fantastic downtown Seattle site at the Westin Hotel. From the Twin Towers of the Seattle Westin Hotel you will enjoy beautiful panoramic views of Puget Sound, Lake Washington, downtown Seattle, and Mount Rainier. An airport shuttle bus is available for \$8.50 one-way and \$14.00 round trip. The airport shuttle coupled with the free downtown bus service eliminates the need for a rental car. However, if a car is desired, two rental companies are located across the street from the Westin.

The downtown location provides an excellent opportunity to include your spouse and family in your travel plans. A spouse's hospitality suite will be available and the downtown location provides a number of exciting and interesting attractions within the immediate area. There are numerous sites to visit that include: museums, galleries, waterfront shops and markets, aquariums and zoos, and a natural rain forest. A number of unique shopping experiences including Nordstrom's, Neiman Marcus, The BonMarche, and two indoor shopping centers with many specialty shops are located near the Seattle Westin Hotel. In addition, monorail access is available across the street from the hotel to take you directly to all the attractions at Space Needle Park.

We in the RAMS family look forward to seeing you in Seattle!!!!!!

Lynwood Rabon, DoD PM-MEP
2002 RAMS General Chairperson

Late Breaking News

The *IEEE Accelerated Stress Testing (AST) Workshop* was scheduled to be held in Seattle last September. It was cancelled after the tragic events of September 11th. At press time we are discussing the possibility of establishing a track for the authors of that workshop to present their work at RAMS 2002. Watch our web site, www.rams.org, for current information between now and January 2002.

Registration Information

Go to www.RAMS.org to register

Registration Fees	Advance	Door
	On or before Jan 11	After Jan 11
* Members of AIAA, ASQ, IEEE, IEST, IIE, SAE, SOLE, SRE, SSS	\$575	\$675
* Nonmembers	\$675	\$775
† Student (<i>Full Time - Student ID required</i>)	\$60	\$60
† One day registration	n/a	\$320
* Includes Banquet, Proceedings, Tutorial Notes, and all paper, panel and tutorial sessions.		
† Includes Proceedings, Tutorial Notes, and all paper, panel and tutorial sessions.		

For advance registration, go to our Web Site at www.rams.org and follow instructions. You may also register by mail using the Registration Form (Form B) on page 23 of this Program and send payment to the address shown below. **Payment IN FULL MUST accompany this completed form.** Checks in US Dollars displaying US banking system transit number, made payable to RAMS 2002 will be accepted. We also accept VISA, MasterCard, or AMEX. Credit Cards will be charged the full amount upon receipt. Please call to make special payment arrangements. Online registrations will be acknowledged by e-mail. Allow 3 weeks for acknowledgment of mailed registrations. Advanced registrations **MUST** be in our hands by January 11, 2002. No registrations will be accepted January 12 through 26, 2002. There are no limitations on number of attendees wishing to register at the door, but fees are \$100 additional except for students. Advance registrations are **NON-REFUNDABLE** after January 11, 2002.

DO NOT INCLUDE HOTEL FEES WITH THE ADVANCE REGISTRATION CHECK.

Dr. Raymond W. Sears
23 Fairway Drive
P.O. Box 1407
Graham, NH 03753-1407 USA

1-603-863-2832
r.w.sears@ieee.org

Please PRINT and use HOME ADDRESS to assure retention of your name on the Symposium mailing list. For additional advance registrations, please copy the Advance Registration Form or print it from www.rams.org.

NOTICE — Sunday, January 27, 2002 Symposium Registration

The Westin Seattle Hotel • Cascade Foyer North Registration Area • 3:30 PM to 6:00 PM
Avoid the Monday Morning Rush!

Discount for Multiple Registrations

RAMS offers a 33% discount for multiple Advance Registrations from the same organization. If you register six or more simultaneously the Member Rate is \$384 and the Non-Member Rate is \$450. You get six RAMS registrations for the price of four! Please contact Dr. Sears as shown above for further information and to arrange for online registration.

Special Travel Rates

Special discounted airfares for the 2002 Reliability & Maintainability Symposium in Seattle, WA on January 28-31, 2002 have been negotiated by IEEE Global Travel Services. Discounts are as high as 20% off the lowest published airfares with American, TWA, Continental and United airlines. If Saturday night stays or super-saver airfares are not applicable, zone fares are available. Discount code A606098 entitles attendees to receive special rates that have also been negotiated with Avis Rental Car Company. Travel arrangements using the negotiated air carriers or the carriers of your choice can be made through IEEE Global Travel Services by calling between the hours of 8:30 a.m. and 5:30 p.m. EST. Monday through Friday. Within the US and Canada, call (800) TRY-IEEE, (800)-879-4333; and outside of the US and Canada, call (732) 562-5387. Or, you may visit their on-line travel service web site at www.ieeeetravelonline.org. This secure site offers simple and convenient service through which you can search, reserve, and ticket your travel anytime, anywhere. You may also fax your requirements to the IEEE Global Travel Services at (732) 562-8815. When faxing, please be sure to include your travel dates, departure & return times, phone and fax numbers. A Travel Counselor will contact you promptly.

Hotel Reservations

A block of rooms has been reserved at the Seattle Westin Hotel. Request the R&M Symposium (RAMS) rate when calling or writing. For your convenience, you can send the Hotel Reservations Form (Form A on page 23) directly to the Seattle Westin Hotel at the address on the form or use it to make your reservations by FAX. A limited number of government rate rooms will be available. Hotel reservations are requested before January 5, 2002. Reservations must be guaranteed by deposit or credit card when making the reservation. The hotel accepts most major credit cards. Deposits are refundable if cancellation is received by the hotel before 6:00 PM on the day of arrival. Arrangements have been made at alternative hotels in the Seattle area in the case of over-booking at the Seattle Westin Hotel. Rate and availability of the alternative hotels may be different than the Seattle Westin Hotel. In the case of over-booking, reservations will automatically be assigned to the next closest alternate hotel. Please call the Seattle Westin Hotel for hotel confirmation and information.

RAMS Exhibition

Every exhibitor has been carefully selected with improved reliability, maintainability, quality, and productivity in mind. All exhibits will be located in the Grand III room of the Seattle Westin Hotel. Coffee breaks will be held in the exhibit area. The Exhibition is a valuable component of the *R&M Symposium* as it provides information on products and services which can help you do your job more efficiently. Even if you plan to attend every technical session, there will still be plenty of time to visit the exhibits between sessions and during lunch periods. The Exhibition is scheduled to be open at the following times:

Monday, January 28	5:00 PM — 7:00 PM
Tuesday, January 29	9:00 AM — 5:00 PM
Wednesday, January 30	9:00 AM — 5:00 PM

2002 Exhibition Space Still Available!

At press time, there were still a few booths available in the exhibit area for this years RAMS. Contact: RAMS EXHIBITION MANAGER; David F. Barber, Jr.; Scien-Tech Associates, Inc., P.O. Box 2097, Banner Elk, NC 28604-2097 USA at 1-828-898-6375, email: dbarbsta@aol.com or by FAX at 1-828-898-6379. David can also provide information on the Year 2003 RAMS Exhibition to be held at the Tampa Waterside Marriott, Tampa, FL USA.

Meet the Speakers!

The Exhibits Area, Grand III room will also serve as a gathering place to provide opportunities to explore topics presented by the speakers. Speakers will be asked to go to this area immediately after their sessions to answer additional questions or continue discussions.

Spouses' Hospitality Suite

The Spouses' Hospitality Suite is available for an informal gathering. Information will be provided regarding tour information, shopping, dining, and places of interest in Seattle. The Spouses' Hospitality Suite, located in the Baker Room will be open from 8:00 AM through 5:00 PM Monday through Wednesday and Thursday from 8:00 AM until 12:00 Noon. Coffee, tea and danish will be provided at 8:00 AM each day. On Monday and Tuesday mornings from 8:00 AM until 10:00 AM, we will discuss the many activities available in Seattle and the surrounding area. The suite affords the opportunity for spouses to get together with one another to plan their day. Please stop by; meet old friends and make some new ones. Seattle is a city rich in attractions and things to do.

Continuing Education Units (CEUs)

You can earn CEUs by attending our Tutorials and Workshops (0.1 CEU per hour). Simply use a CEU completion form included with your *Tutorial Notes*. Complete the form according to the instructions, and return it at the conclusion of the Symposium. RAMS charges each applicant \$15.00 for processing. Your CEU certificate will be mailed to you.



Job Posting Board

This year the *Symposium* is sponsoring a job posting board on which openings in the assurance disciplines can be posted. ANY business interested in describing its employment opportunities to the world's premier gathering of assurance professionals is asked to contact Ray Sears at 1-603-863-2832 or by email: r.w.sears@ieee.org. The bulletin board will be made available to all *Symposium* attendees. This is an extraordinary opportunity to get your employment message out!

Emergency Information

A Message Center will be provided for the convenience of *Symposium* attendees. Messages for attendees may be left between 8:00 AM and 5:00 PM during the *Symposium* by dialing **1-206-728-1000** and asking for the *RAMS Symposium Message Center*. All messages will be posted at the Message Center located in the RAMS Registration area.

Certified Reliability Engineer Examination

Special arrangements have been made with the American Society for Quality (ASQ) for attendees who so desire to take the ASQ CRE examination while at the *Symposium*. A significantly reduced rate is offered for paid RAMS attendees. The 4 hour examination will be held on Thursday morning. On Tuesday, a 4 hour workshop session will be held for the benefit of those who plan to take the examination, are thinking about taking it some time in the future, or are just curious. Advance registration will guarantee a seat. Information about exam fees, registration and professional prerequisites for this certification exam are available at the RAMS WEB site or by calling ASQ at 1-800-248-1946. Ask for customer service. The exam is open book. Pocket calculators without programmable memories are allowed. Registrations will be accepted up to noon on Wednesday of the *Symposium* on a space available basis.

University and College Information Table

Attention Universities and Colleges: RAMS now offers accredited Universities and Colleges the opportunity to provide information about programs which address the needs of RAMS attendees. The Exhibits Area will include a table for pamphlets or information packets which can be picked up by interested RAMS attendees. There is no charge for this service. Information may be about degree programs, short courses or certificate programs offered by the institution. (No Conference or Symposium Information, please.) Contact C.W. Plotkin at 1-734-523-6178 or cplotkin@ford.com for information or to make arrangements to place your material at this table. RAMS will make the final determination regarding suitability, and arrangements must be made prior to the Symposium. There is a limit of one brochure / information packet type per institution.

2002 RAMS Exhibitors

ABS Consulting
ARINC
BQR Relification Software, Ltd
Clockwork Solutions
Data Systems & Solutions
Fulton Findings™
GIDEP
IIT Research Institute/Reliability
Analysis Center
Independent Design Analyses, Inc.
Isograph, Inc.
Item Software (USA), Inc.
Relex Software Corporation
ReliaSoft Corporation
The Omnicon Group, Inc.

Program Matrix

	Time	Grand I	Grand II	Cascade II	Cascade I	Cascade Foyer North Registration Area
Monday	8:00 - 10:00 AM	Tutorial 1A Introduction to Reliability	Tutorial 1B Warranty and Reliability	Tutorial 1C Integrated Reliability & Maintainability Program-Planning	Tutorial 1D Applying Probabilistic Methods to Design and Reliability Modeling	REGISTRATION 7:00 AM - 6:00 PM
	10:15 - 12:15 PM	Tutorial 2A Statistical Analysis of Reliability, Maintainability, and Supportability Data	Tutorial 2B Human Reliability Analysis	Tutorial 2C Assembling Systems/Network Reliability	Tutorial 2D Understanding Electronic Parts Failure Mechanisms	EXHIBITS Grand III 5:00 PM - 7:00 PM
	1:15 - 2:15 PM	GENERAL CHAIRPERSON'S WELCOME GRAND 1				
	2:30 - 5:00 PM	Tutorial 3A Practical Reliability Engineering & Management		Tutorial 3C Dynamic Robust Design	Workshop 3D R&M CAE Capabilities Exhibitors' Presentations & Demonstrations	
Tuesday	8:00 - 10:00 AM	Tutorial 4A Introduction to Repairable-Systems Modeling	Tutorial 4B Fault Tree Analysis in Product Reliability Improvement	Session 4C Life Cycle Cost and Cost Benefit Analysis	Session 4D Statistical Methods for R&M Analysis	REGISTRATION 7:30 AM - 5:00 PM
	10:15 - 12:15 PM	Session 5A Maintenance and Availability Modeling Sponsored by IIE	Session 5B Safety & Risk Management Assessment	Tutorial 5C Thermodynamic Reliability Engineering	Workshop 5D R&M CAE Capabilities Exhibitors' Presentations & Demonstrations	EXHIBITS Grand III 9:00 AM - 5:00 PM
	1:30 - 3:30 PM	Session 6A Lessons Learned	Session 6B Fault Trees and FMECA	Panel 6C Logistics and Supportability Panel	Tutorial 6D Implementing Reliability Centered Maintenance (RCM)	CRE Review St. Helens 8:00 AM - 12:00 PM
	3:45 - 5:45 PM	Tutorial 7A Introduction to Probabilistic Risk Assessment	Session 7B R&M Programs in a Commercial and Industrial Environment	Session 7C Software Reliability & Maintainability Analysis	Tutorial 7D How to Justify Your Modeling Results	
Wednesday	8:00 - 10:00 AM	Tutorial 8A Understanding Accelerated Life-Testing Analysis	Tutorial 8B Reliability & Availability Modeling using the Sharpe Software Package	Session 8C R&M Optimization	Panel 8D Innovative R&M Technology Applications Panel	REGISTRATION 7:30 AM - 3:30 PM
	10:15 - 12:15 PM	Session 9A Defect Detection in Software Engineering	Session 9B Accelerated Life Testing	Tutorial 9C Modeling of Realistic Systems Using the Monte Carlo Method	Session 9D Application of Software Tools to R&M Analysis	EXHIBITS Grand III 9:00 AM - 5:00 PM
	1:30 - 3:30 PM	Panel 10A International Space Station Safety and Mission Assurance Performance Metrics Panel	Tutorial 10B Fault Tree Analysis of Computer Based Systems	Session 10C Modeling & Simulation	Session 10D Product Design & Assurance	
	3:45 - 5:45 PM	Panel 11A ADVISORY BOARD PANEL GRAND 1		Session 11C Reliability Modeling of Systems	Session 11D TL9000 Session Sponsored by ASQ	
	6:30 - 7:30 PM	GENERAL RECEPTION - Grand Foyer				
	7:30 - 10:00 PM	SYMPOSIUM BANQUET - Grand I & II				
Thursday	8:00 - 10:00 AM	Tutorial 12A Fuzzy Logic	Session 12B Quality & Product Assurance	Session 12C Reliability Prediction Methods	Session 12D R&M Techniques and Applications	REGISTRATION 7:30 AM - 12:30 PM
	10:15 - 12:15 PM	Tutorial 13A Introduction to Software Reliability Risk Management	Panel 13B Infant Mortality Panel	Session 13C R&M in Aerospace	Session 13D Environmental Testing and Stress Screening	ASQ CRE Exam Grand Crescent 8:00 AM - 12:00 PM

Exhibits will be in the Grand III Room

MONDAY SCHEDULE

8:00 AM — 10:00 AM

Tutorial 1A (Linked to Paper Sessions 4D, 6B, 7B & 12C) **INTRODUCTION TO RELIABILITY**

Introductory

Grand I

Dr. John D. Healy, *Telcordia Technologies*

This tutorial serves as an introduction to the main concepts in reliability. It describes how reliability is measured, modeled, analyzed, and managed.

Tutorial 1B (Linked to Paper Sessions 4C, 8C, 10D & 12D) **WARRANTY AND RELIABILITY**

Special Topic

Grand II

Wallace R. Blischke, *University of Southern California* and **D. N. P. Murthy**, *The University of Queensland*

The cost of a warranty is inversely related to the reliability of the product, which also has an appreciable cost. Trade-offs between these costs is an essential aspect of effective warranty management.

Tutorial 1C (Linked to Paper Sessions 7B, 13C & Panel 10A) **INTEGRATED RELIABILITY & MAINTAINABILITY PROGRAM-PLANNING**

Introductory

Cascade II

Scott A. Fratianne, *Blackhawk*, and **Dan C. Burrows**, *Gilman*

This tutorial provides an introduction to Reliability and Maintainability (R&M) planning. The tutorial describes proven tools and techniques that integrate the concepts and methods of life cycle-centered R&M into an engineering and manufacturing environment.

Tutorial 1D (Linked to Paper Sessions 4D, 10C, 10D & 11C) **APPLYING PROBABILISTIC METHODS TO DESIGN AND RELIABILITY MODELING**

Special Topic

Cascade I

Ronald H. Salzman, *Ford Motor Company*, **Michael H. Packard**, *SAIC*, and **James A. McLinn**, *Consultant*

Probabilistic design and probabilistic reliability prediction represents cutting edge technology that brings variability of manufacturing, fabrication, material properties, loading and environmental effects to the design and reliability prediction process. This tutorial presents a broad description of basic concepts involved in application of probabilistic methods to component design with real-world examples.

10:15 AM — 12:15 PM

Tutorial 2A (Linked to paper Sessions 4D & 7C) **STATISTICAL ANALYSIS OF RELIABILITY, MAINTAINABILITY, AND SUPPORTABILITY DATA**

Introductory

Grand I

Dr. Caroline Smith, *James Madison University*

This tutorial gives an introduction to the key concepts and techniques used in statistical analyses of reliability, maintainability, and supportability data. The presentation includes the mechanics of the analysis, interpretation of the results, and pitfalls to avoid.

Tutorial 2B **HUMAN RELIABILITY ANALYSIS**

Intermediate

Grand II

Joseph R. Fragola, *SAIC*

This tutorial will present the basic principles in performing a Human Reliability Analysis in conjunction with the quantitative assessment of the reliability and risk of systems and equipment. The approach taken follows the general systems engineering paradigm and is therefore readily compatible with hardware and software systems reliability approaches.

Tutorial 2C (Linked to Paper Sessions 9D, 10C & 11C) **ASSEMBLING SYSTEMS/NETWORK RELIABILITY**

Introductory

Cascade II

Jason W. Rupe, *Qwest Communications Int'l*

This tutorial reminds reliability practitioners why modeling system or network reliability is important & beneficial, and introduces new concepts as well. We cover some of the concepts behind modeling, reasons to model a network/system's reliability, perspectives that are important for predicting effectiveness and some of the modeling approaches & tools available.

Tutorial 2D (Linked to Paper Session 13D) **UNDERSTANDING ELECTRONIC PARTS FAILURE MECHANISMS**

Intermediate

Cascade I

John W. Knepley, *Northrop Company*

This tutorial describes the common failure mechanisms commonly encountered in the operation and testing of electronic systems, and the ways in which their occurrence can be minimized to achieve system reliability goals. The tutorial includes and augments the hard copy.

1:15 PM — 2:15 PM

GENERAL CHAIRPERSON'S WELCOME AND KEYNOTE

Grand I



Jefferson Howell, Jr.

General Chairperson — **Lynwood Rabon**, *DoD PM-MEP*

Keynote Speaker — **Lt. Gen Jefferson D. "Beak" Howell, Jr.**, *USMC Ret.*

Our keynote speaker, **Lt. Gen. Jefferson D. Howell, Jr.**, *USMC Ret.*, is a Senior Vice President with *Science Applications International Corporation*, and is the Program Manager for the Safety, Reliability, and Quality Assurance Contract at NASA's Johnson Space Center in Houston Texas. General Howell, a decorated naval aviator and Vietnam veteran, has served a distinguished career in the Marine Corps spanning nearly thirty years, in which he held many leadership roles and commands, culminating in the responsibility for all the Marine Corp Forces in the Pacific region. Gen. Howell's current responsibilities include providing the reliability and maintainability resources that ensure successful and safe flight of many of NASA's manned and unmanned flight programs, including the Space Shuttle and Space Station Programs. Gen. Howell will discuss the many challenges he faced as a Naval Aviator and Commander of Marine Corp resources, as well as the future of the reliability and maintainability engineering disciplines as they relate to both commercial and government applications. He will stress the importance of the R&M disciplines in product and program development and operation, as we move into the 21st Century and continue to address the new challenges in the world around us.

MONDAY SCHEDULE CONT'D

2:30 PM — 5:00 PM

Tutorial 3A (Linked to Paper Sessions 7B, 10D, 12B & 13C)

Introductory

Grand I

PRACTICAL RELIABILITY ENGINEERING AND MANAGEMENT

Dr. Ralph A. Evans, *Evans Associates*

This practical tutorial explains what a reliability program is really all about and the kinds of things that reliability engineers and managers must do to institute a successful program. No mathematics. No statistics. ... Plenty of insight and things to think about.

Tutorial 3C (Linked to Paper Sessions 10D & 12D)

Special Topic

Cascade II

DYNAMIC ROBUST DESIGN

Madhav S. Phadke, *Phadke Associates Inc*

Robust Design is a method for making the function of a product or process least sensitive to all sources of variation. This introductory tutorial discusses how to improve reliability and reduce cost using Robust Design.

Workshop 3D (Linked to Workshop 5D & Paper Session 9D)

Cascade I

R&M CAE CAPABILITIES: EXHIBITORS' PRESENTATIONS AND DEMONSTRATIONS

Thomas Brogan, *Raytheon*

R&M CAE tools continue to evolve in support of industry's business processes. Our RAMS Exhibitors will highlight their latest functionality through brief presentations and application demonstrations in a neutral setting. Please check outside the room for the vendor presentation schedule.

TUESDAY SCHEDULE

8:00 AM — 10:00 AM

Tutorial 4A (Linked to Paper Sessions 5A & 8C)

Intermediate

Grand I

INTRODUCTION TO REPAIRABLE-SYSTEMS MODELING

C. Richard Cassady, *University of Arkansas* and **Edward A. Pohl**, *US Military Academy*

The problem of optimal maintenance planning is relevant to all industries. The fundamental concepts and approaches related to modeling repairable systems and optimizing maintenance schedules are presented.

Tutorial 4B (Linked to Paper Sessions 6B & Tutorial 10B)

Introductory

Grand II

FAULT TREE ANALYSIS IN PRODUCT RELIABILITY IMPROVEMENT

Milena Krasich, *Bose Corporation* and **Julio C Gallardo**, *University of Bristol*

The tutorial describes how Fault Tree Analysis (FTA) is applied to products as a top down method for identification and mitigation of potential field failures during the design phase. By modeling the system functionality and architecture the analysis allows estimation of system reliability, tradeoff, and evaluation of reliability improvement resultant from failure mode mitigation before the design is complete.

Session 4C (Linked to Tutorial 1B)

Cascade II

LIFE CYCLE COST AND COST BENEFIT ANALYSIS

Moderator: Sandra Leiker, *U.S. Air Force*

The diverse application of Life Cycle Cost (LCC) tenants and analyses are instrumental to accomplish cost versus benefit tradeoffs.

4C1 A STUDY OF ON-LINE MAINTENANCE PRACTICES AT US NUCLEAR PLANTS

James Chow Lin, *EQE International*

A refreshing look at maintenance activities versus power generation operations.

4C2 RISK-INFORMED RELIABILITY-FOCUSED DECISION ANALYSIS SUPPORT FOR EFFECTIVE FACILITY-CHANGE MANAGEMENT

James Keith Liming and **Brian Keith Olson**, *EQE International Inc*

Optimizing resources to maximize return on electric generating systems.

4C3 OPTIMIZING INTERVALS FOR INSPECTION & FAILURE-FINDING TASKS

Bonnie S. Hauge, *United Space Alliance*

Presents robust toolbox for determining the best maintenance.

4C4 PRIORITIZING THE PURCHASE OF SPARE PARTS USING AN APPROXIMATE REASONING MODEL

Stephen W. Eisenhower, **Terry F. Bott**, and **Joseph W. Jackson**, *Los Alamos National Laboratory*

A decision theoretic methodology for providing a more robust sparing model.

4C5 AVAILABILITY CENTERED MAINTENANCE (ACM), AN INTEGRATED APPROACH

Daniele Saccardi, *Consultant*, and **Giuseppe Fabio Ceschini**, *GE Power Systems*

A practical look at availability through management and optimization.

Plan now to present a paper, tutorial or to attend the Year 2003 RAMS at the Tampa Waterside Marriott, Tampa, FL USA, January 27 - 30, 2003. For more information, visit our Web site at: <http://www.rams.org>.

TUESDAY SCHEDULE CONT'D

Session 4D (Linked to Tutorials 1A, 1D, 9C & 12A)

Cascade I

STATISTICAL METHODS FOR R&M ANALYSIS

Moderator: C. Richard Cassady, *University of Arkansas*

Effective R&M Analysis may depend upon the proper application of statistical tools. This session provides some new methods and tools that can help improve the ability to draw conclusions from your data.

- 4D1 **A PATH-BASED ALGORITHM TO EVALUATE ASYMPTOTIC UNAVAILABILITY FOR LARGE MARKOV MODELS**
Yannick Lefebvre and **Marc Bouissou**, *Electricite de France*
An algorithm is developed which exploits a path-based approach to evaluate the asymptotic unavailability of a system which is completely and quickly repairable. The algorithm is used to analyze an electrical power system.
- 4D2 **A SIMPLE GRAPHICAL APPROACH FOR COMPARING RELIABILITY TRENDS OF DIFFERENT UNITS IN A FLEET.**
Loon Ching Tang and **Min Xie**, *National University of Singapore*
Uses a piecewise Homogeneous Poisson Process to model a fleet of repairable systems made up of different LRUs. Develops a graphical approach for comparing reliability trends of units in a fleet and between different fleets with identical sets of units.
- 4D3 **FAILURE-DATA ANALYSIS BY MIXTURE OF 3 WEIBULL DISTRIBUTIONS**
Tieling Zhang, *Tokyo University of Mercantile Marine*, and **Yukun Ren**, *Louisiana State University*
This paper investigates approaches to analyzing and fitting data to models involving three Weibull distributions. This paper shows that these models provide flexibility in fitting and explaining failure data.
- 4D4 **SAMPLE SIZES FOR SYSTEM RELIABILITY**
Vijendra P. Singh and **Swami Sankaran**, *Sun Microsystems*
This paper presents a methodology for determining sample sizes for system availability under the assumption that the time between failures and the time to repair are independently and exponentially distributed.
- 4D5 **COMPREHENSIVE REVIEW OF ESTIMATING SYSTEM-RELIABILITY CONFIDENCE-LIMITS FROM COMPONENT-TEST DATA**
Xijin Tian, *The University of Arizona*
This is a survey paper that summarizes the literature and compares methods and models for establishing confidence limits on a system.

Workshop 4E

St. Helens

ASQ CERTIFIED RELIABILITY ENGINEER (CRE) REVIEW

This session is for the benefit of those attendees who are registered to take the ASQ CRE Examination, are considering taking the examination this week or some time in the future, or are simply curious. Experts in the reliability field will review typical examination material.

10:15 AM — 12:00 PM

Session 5A (Linked to Tutorial 4A)

Grand I

MAINTENANCE AND AVAILABILITY MODELING SPONSORED BY IIE

Moderator: John R. English, *University of Arkansas*

This session presents an interesting collection of papers that examine the relationship of maintenance modeling, analysis and logistic support on system performance. New techniques, models and applications provide insight and value for today's engineers.

- 5A1 **A METHOD FOR MEASURING SUPPLY-CHAIN RELIABILITY FOR CONTINGENCY OPERATIONS**
Marlin U. Thomas, *Purdue University*
A method for quantifying the reliability of supply chains for contingency logistics systems is developed based on reliability interference theory. Provides results for series/parallel configurations and several risk conditions for the supply chain links.
- 5A2 **MAINTENANCE-COST MODELING FOR A REFRIGERATED-TRAILER FLEET**
C. Richard Cassady, **Darin W. Nutter**, **G. Don Taylor**, and **Chet Tuck Wong**, *University of Arkansas*
Operational failure and repair costs for the refrigeration systems used in a fleet of refrigerated trailers are modeled and analyzed using FMEA, FTA, and simulation. A designed experiment is used to estimate refrigeration maintenance costs.
- 5A3 **RELIABILITY IMPROVEMENT OF AIRPORT GROUND-TRANSPORTATION VEHICLES USING CONDITION-BASED MAINTENANCE**
Alice E. Smith, **David W. Coit**, *Rutgers University* and **Curtis W. McCullers**, *Adtranz*
Describes a joint industry/university collaboration to develop a prototype system to provide real time monitoring of an airport ground transportation system vehicle with the objectives of improving availability and minimizing field failures.
- 5A4 **INPUT DATA CHARACTERIZATION FACTORS AFFECTING AVAILABILITY ESTIMATION ACCURACY**
Darren P. Durkee, *United States Air Force*, **Edward A. Pohl**, *US Military Academy* and **Edward F. Mykytka**, *University of Dayton*
A design of experiments approach is utilized to investigate the factors that impact the probabilistic characterization of component failure and repair behavior with respect to the effect on system availability estimates.
- 5A5 **OPTIMIZING CONDITION-BASED MAINTENANCE DECISIONS**
Andrew K.S. Jardine, *University of Toronto*
Reviews common strategies for implementing smart condition monitoring decisions and employs proportional hazards modeling to identify the key risk factors that should be used to identify the health of equipment during condition monitoring.

TUESDAY SCHEDULE CONT'D

Session 5B (Linked to Panel 10A)

Grand II

SAFETY & RISK MANAGEMENT ASSESSMENT

Moderator: Robert J. Loomis Jr., NASA

A discussion of Safety and Risk Management for highly complex systems, along with the balancing of safety and business performance.

- 5B1 **NORMAL ACCIDENT-THEORY VALIDATED: INTERACTIVE COMPLEXITY AND RESOURCE AVAILABILITY AS PREDICTORS OF RELIABILITY**
Frederick G. Wolf, Pacific Lutheran University
Through the investigation of petroleum refineries this paper links the role of coupling as determined by financial resource availability to the environmental risk of this class of highly technical systems.
- 5B2 **RELIABILITY & AVAILABILITY EVALUATION FOR HIGHLY-MESHED NETWORK-SYSTEMS**
Andrea Carpignano, Michelle Piccini, and Maurizio Gargiulo, Politecnico di Torino
Addresses the problem of the reliability and availability assessment of meshed network systems using as an example the district heating network of Torino, Italy.
- 5B3 **GENERALIZED IMPERFECT COVERAGE PHASED-MISSION RELIABILITY, PERFORMANCE, AND SENSITIVITY EVALUATION**
Joanne Bechta Dugan and Liudong Xing, University of Virginia
Considers the problem of assessing the reliability, performance, and sensitivity of phased mission systems with combinatorial phase requirements and generalized imperfect coverage.
- 5B4 **HOW SAFETY-INVESTMENTS INCREASE PERFORMANCE: A PRACTICAL CASE**
Patrick M. W. Korvers, Peter J.M. Sonnemans, and Aarnout C. Brombacher, Eindhoven University of Technology
A method is presented to model, analyze, and qualify the control of an operational process to improve both the safety performance and business performance.
- 5B5 **RISK ANALYSIS USING A HYBRID BAYES-APPROXIMATE REASONING METHOD**
Terry F. Bott and Stephen W. Eisenhower, Los Alamos National Laboratory
Presents a method for generating Bayesian prior distributions of a Poisson parameter using approximate reasoning.

Tutorial 5C (Linked to Paper Session 13D)

Special Topic

Cascade II

THERMODYNAMIC RELIABILITY ENGINEERING

Dr. Alec A. Feinberg, M/A-COM Incorporated

This tutorial illustrates key aspects linking the laws of thermodynamics and reliability physics into a true science of thermodynamic reliability engineering. Numerous common physics-of-failure mechanisms caused by diffusion, activation, and/or forced aging are illustrated (with FA photos - SEMs, Micrographs, etc.) and explained.

Workshop 5D (Linked to Workshop 3D & Paper Session 9D)

Cascade I

R&M CAE CAPABILITIES: EXHIBITORS' PRESENTATIONS AND DEMONSTRATIONS

Moderator: Thomas Brogan, Raytheon

A continuation of Session 03D, our RAMS Exhibitors will highlight their latest functionality through brief presentations and application demonstrations in a neutral setting. Please check outside the room for the vendor presentation schedule.

1:30 AM — 3:30 PM

Session 6A

Grand I

LESSONS LEARNED

Moderator: Henry N. Hartt, BAE SYSTEMS

Engineering success factors are often learned at high cost to the enterprise. Learning from the experience of others helps to assure that mistakes are not repeated and that critical success factors are communicated.

- 6A1 **ULYSSES, SCYLLA, AND CHARYBDIS - AND THE STORY OF RELIABILITY**
Giorgio Turconi, Italtel spa
An entertaining, insightful, and original interpretation of the Odyssey as an analogy for our need to adapt our methods to accommodate change and the unexpected.
- 6A2 **BEYOND ROOT-CAUSE ANALYSIS**
Per M. Johansson, Ida C. Gremyr, Anders P. Fundin, and Bo L.S. Bergman, Chalmers University of Technology
Root-cause analysis, to include both technical failure modes and non-technical causes such as organizational faults, can be applied to identifying improvement opportunities in the product development process.
- 6A3 **RISK ASSESSMENT IN RAILWAY SIGNALLING: EXPERIENCE AND LESSONS-LEARNED**
Jens Braband, Siemens AG
Three case studies demonstrate a risk analysis approach that covers human and operational factors, as well as design issues.
- 6A4 **A METHOD FOR ACHIEVING AN ENHANCED MISSION CAPACITY**
Larry H. Crow, IITRI
This paper proposes a methodology for using "selected repair" to increase the probability of attaining an enhanced mission time, now required for many complex, maintained systems.

- 6A5 **INTEGRATING RELIABILITY-ENHANCEMENT MODELLING INTO PRACTICE: CHALLENGES AND PITFALLS**
Russell Hodge and John Quigley, University of Strathclyde, Ian James and Jane Marshall, TRW Aeronautical Systems
 A modeling framework supports reliability enhancement decision-making by estimating the reliability of a design throughout the product lifecycle.

Session 6B (Linked to Tutorials 4B & 10B)
FAULT TREES AND FMECA

Grand II

Moderator: Donald C. Johnston, United Space Alliance

This session will review the latest developments in FMEA and Fault Trees as well as examine new areas of application for these time proven tools.

- 6B1 **FMEA OF MARINE SYSTEMS: THE LINK FROM PRESCRIPTIVE TO RISK-BASED DESIGN & CLASSIFICATION**
John A. Farquharson, Joel L. McDuffee, EQE International Inc., and A. K. Seah, Takeshi Matsumoto, American Bureau of Shipping
 Describes the results of recent studies by the American Bureau of Shipping to provide risk based guidelines for performing a failure mode and effects analysis on high-speed crafts and propulsion remote control systems.
- 6B2 **THE FAILURE-ANALYSIS MATRIX: A KINDER, GENTLER ALTERNATIVE FOR FMEA FOR INFORMATION SYSTEMS**
Michael C. Signor, GE Industrial Systems
 Presents a Failure Analysis Matrix as an alternative to Failure Modes and Effects Analysis for prioritizing solutions to failures in information systems.
- 6B3 **HOW TO AVOID THE GENERATION OF LOOPS IN THE CONSTRUCTION OF FAULT TREES**
Italo Ciarambino, Micaela Demichela, Norberto Piccinini, Politecnico di Torino, and Sergio Contini, Commissione Europea
 A method for eliminating loops in manually generated fault trees by generating the fault tree straight from the modules of a well-structured HazOp procedure.
- 6B4 **SERVICE FAULT-TREE-ANALYSIS: ITS USE FOR IMPROVING THE EFFICIENCY OF SERVICE PROCESSES**
Aloysio Antonio Peixoto de Carvalho, Andre Macedo, and Carlos Alberto Scapin, Fundacao de Desenvolvimento Gerencial - FDG
 A case study in which the technique of Fault Tree Analysis was applied in solving a complex systemic failure in a service process carried on by a major aviation company in Southeastern Brazil.
- 6B5 **PROBABILITY EVALUATION OF SYSTEM-FAILURE OCCURENCE BASED ON MINIMAL CUT-SETS**
Takehisa Kohda and Koichi Inoue, Kyoto University
 Proposes an analytical probability evaluation method of system failure occurrence based on critical states for each basic event.

Panel 6C
LOGISTICS AND SUPPORTABILITY PANEL

Cascade II

Moderator: Dr. Ralph L. Harper Jr., Raytheon Technical Service Company

Panelists will address logistics and supportability issues as well as the relevance and effects of R&M considerations on logistics and support of products.

Panelists:

C. M. (Chuck) Huber, Co-Chair, NDIA's Reliability, Maintainability, and Quality Subcommittee, Huber Consultants International
Tom Edmonds, SES, Deputy to the Commander, U.S. Army Combined Arms Support Command
John F. Phillips, Vice President, Aftermarket Growth Defense & Space, Honeywell
Major General Hawthorne Proctor, Director, Logistic Operations, Defense Logistics Agency
Brigadier General John M. Urias, Deputy CG for Acquisition, US Army Space and Missile Defense Command
Jerry Hudson, General Manager, CTC and Chairman NDIA's Quality Subcommittee

Tutorial 6D (Linked to Paper Session 8C)
IMPLEMENTING RELIABILITY CENTERED MAINTENANCE (RCM)

Special Topic

Cascade I

William A. Mercier, American Management Systems, Inc.

Classic RCM methodologies are extended using a Backfit process that yields the required system and equipment reliability at the lowest maintenance cost.

3:45 AM — 5:45 PM

Tutorial 7A
INTRODUCTION TO PROBABILISTIC RISK ASSESSMENT

Introductory

Grand I

Dr. Michael V. Franks, Safety Factor Associates, Inc.

This tutorial is an introductory overview of the value therein and methods of performing a probabilistic risk assessment (PRA) and the additional value it adds to a product or system development project. Within the context of a step-by-step example, topics include: concepts, principles, methods, propagation of uncertainties, and decision-making.

TUESDAY SCHEDULE CONT'D

Session 7B (Linked to Tutorial 1C)

Grand II

R&M PROGRAMS IN A COMMERCIAL AND INDUSTRIAL ENVIRONMENT

Moderator: Dr. Ralph L. Harper Jr., Raytheon Technical Service Company

Addresses the development and implementation of reliability and maintainability processes and program elements for commercial and industrial products to achieve specific requirements.

7B1 **REFRIGERATOR FAILURE EARLY PREDICTION BASED ON WARRANTY DATA**

Ke Liu, Honeywell Aerospace Electronic Systems

Methods to predict the failure characteristics of refrigeration components based on warranty returns data.

7B2 **AUTOMATED REAL-TIME TESTING (ARTT) FOR EMBEDDED CONTROL SYSTEMS (ECS)**

Jon Hawkins, Reginald B. Howard, and Haung V. Nguyen, Argonne National Laboratory

Testing methodology used to test structure for personnel safety system using software-testing tools.

7B3 **CAN CABLE-TELEVISION AVAILABILITY REACH THAT OF THE TELCOS? THE ROAD TO 5NINES**

Michael G. Gonzales, Motorola Inc.

The effects of hardware, software, and human factors on cable television availability.

7B4 **RELIABILITY-ANALYSIS SYSTEM FOR RISK MANAGEMENT OF LNG RECEIVING TERMINALS AND PIPING NETWORKS**

Daisuke Takagi, Kazuo Koyama and Kazutaka Miura, Tokyo Gas Co., Ltd, and **Katsunori Kawai,** Mitsubishi Heavy Industries, Ltd.

Reliability analysis and its application to Liquefied Natural Gas (LNG).

7B5 **INTEGRATED SYSTEM FOR RELIABILITY-MODELING OF COLD PLASTIC DEFORMATION TOOLS USED IN THE CAR INDUSTRY**

Calin Florin Baban, Alexandru Viorel Pele, and Marius Baban, University of Oradea

Reliability modeling used in assurance of cold plastic deformation.

7B6 **RELIABILITY ANALYSIS AND PARAMETER OPTIMIZATION OF RANDOM-VIBRATION SYSTEMS**

Ming-Xiao Jiang, General Electric

The Single-Degree-Of-Freedom (SDOF) and Two-Degree-Of-Freedom (TDOF) models are investigated for reliability against the acceleration failure.

Session 7C (Linked to Tutorial 13A)

Cascade II

SOFTWARE RELIABILITY & MAINTAINABILITY ANALYSIS

Moderator: Samuel J. Keene Jr., Seagate Technology

With the increase of software content in today's products, our ability to estimate, measure, and improve Software Reliability and Maintainability (R&M) becomes more important. This session addresses advances in techniques to model and estimate Software R&TM.

7C1 **SCENARIO-BASED UNIT TESTING FOR RELIABILITY**

Silke Kuball, Gordon Hughes, and Julio C Gallardo, University of Bristol, and **Ian Gilchrist,** IPL Information Procession Limited

Addresses assessment of software reliability and availability for safety critical systems using operational profile software testing.

7C2 **THREE MODIFIED DEPENDENCY-TESTS FOR SOFTWARE FAILURES**

Ching-Cheng Wang and Ronald Jung-Wen Chen, National Cheng Kung University

Explores dependency tests of software failures while implementing N-Version programming for fault tolerant systems.

7C3 **AN INTEGRATED MEASURE OF SOFTWARE MAINTAINABILITY**

Krishan K. Aggarwal, Yogesh Singh, Indraprastha University, and Jitender Kumar Chhabra, Regional Engineering College

Discusses an integrated approach for estimating software maintainability based on Readability of Source Code, Documentation Quality, and Understandability Of Software methods.

7C4 **INVESTIGATING A SPECIFIC CLASS OF SOFTWARE RELIABILITY-GROWTH MODELS**

Peter A. Keiller, Howard University, and **Thomas A. Mazzuchi,** The George Washington University

Addresses research into how the performance of various inter-failure and failure count Software Reliability Models can be improved using smoothing techniques.

7C5 **USING STRUCTURE TO GAIN INSIGHT INTO THE RELIABILITY OF HIERARCHICAL SOFTWARE SYSTEMS**

Sylvain P. Leblanc, Royal Military College of Canada and **Paul A. Roman,** Canadian Army Experimentation Centre

Explores how a graph of control flow between software modules can be transformed into a RBD to gain a Software Reliability Estimate figure relevant to Object Oriented programs.

Tutorial 7D

Special Topic

Cascade I

HOW TO JUSTIFY YOUR MODELING RESULTS

Meng-Lai Yin, Raytheon Company

Justifying your modeling results is as important as constructing and solving the model. This tutorial organizes and summarizes the methodologies that have been successfully applied in various projects, such as software reliability estimations, availability and safety analyses for satellite navigation systems.

WEDNESDAY SCHEDULE

8:00 AM — 10:00 AM

Tutorial 8A (Linked to Paper Sessions 9B & 13D)

Special Topic

Grand I

UNDERSTANDING ACCELERATED LIFE-TESTING ANALYSIS

Pantelis Vassiliou and **Adamantios Mettas**, *ReliaSoft Corporation*

Correct analysis of data gathered from testing products under high-stress conditions provides important information for predicting and improving their life under use-stress conditions.

Tutorial 8B (Linked to Paper Session 9D)

Intermediate

Grand II

RELIABILITY & AVAILABILITY MODELING USING THE SHARPE SOFTWARE PACKAGE

Kishor S. Trivedi and **Christophe Hirel**, *Duke University*

A wide range of reliability and availability models are described. The SHARPE software package is a toolchest that can be used to estimate reliability and availability parameters for these models.

Session 8C (Linked to Tutorial 6D)

Cascade II

R&M OPTIMIZATION

Moderator: C. Richard Cassady, *University of Arkansas*

Optimization methods are applied to a variety of R&M problems including equipment replacement, diagnostics, and maintenance planning.

8C1 MAINTANANCE OPTIMIZATION UNDER UNCERTAINTIES, USING INTERVAL-METHODS & UNCERTAINTY-APPROACH

Claudio M. Rocco S., *Universidad Central de Venezuela*

Presents two examples of maintenance optimization under certainties: use of Interval Arithmetic to solve a single variable global optimization problem and an investigation of the range of coordinated maintenance frequencies for multi-component systems.

8C2 MODELLING OF MAINTENANCE, WITHIN DISCRETE-EVENT SIMULATION

Les Warrington, **Jeffery A. Jones**, and **Neil Davis**, *University of Warwick*

This paper investigates the concept of Maintenance Free Operating Periods (MFOP) using a discrete event simulation model.

8C3 USE OF FUNCTIONAL REPRESENTATION DIAGRAM FOR RELIABILITY IMPROVEMENT

James Chow Lin, *EQE International*

This paper presents a functional hierarchy approach that can be used to develop a functional representation diagram for a complicated system.

8C4 TWO-DIMENSIONAL RELIABILITY-MODELING FROM WARRANTY DATA

Guangbin Yang and **Ziad Zaghati**, *Ford Motor Company*

Describes warranty data structure and censoring mechanisms. A sequential regression model is proposed to model mileage accumulation from warranty claim data. A reliability model is developed and used to predict the number of warranty claims. Example.

8C5 THE FAILURE OF MTTF IN AVAILABILITY EVALUATION

Hairong Sun and **James J. Han**, *Motorola*

A truncated bathtub curve is proposed to model the failure rate of a product with perfect burn-in. Several counter intuitive observations are analyzed and discussed.

Panel 8D

Cascade I

INNOVATIVE R&M TECHNOLOGY APPLICATIONS PANEL

Moderator: Dennis R. Hoffman, *Lockheed Martin Aeronautics*

Prognostics & Health Management (PHM) technology can be a critical part of an integrated methodology for system maintenance and health management. PHM provides a comprehensive approach for detecting and isolating failures as well as predicting remaining useful life for critical components. Panelists will address application of PHM technology as a key enabler for improved R&M, Testability, and Logistics.

Panelists:

Dean Hooks, *Boeing*

Bill Nickerson, *RLW, Inc.*

Andy Hess, *NAVAIR JSF Office*

Ken Finklea, *PEI Electronics*

10:15 AM — 12:15 PM

Session 9A (Linked to Tutorial 13A)

Grand I

DEFECT DETECTION IN SOFTWARE ENGINEERING

Moderator: Harold E. Ascher, *Harold E. Ascher & Associates*

Software reliability has become a critical driver in attaining system reliability. Certain software defect detection methodologies have proven effective in real world applications.

9A1 MAKING THE (BUSINESS) CASE FOR SOFTWARE RELIABILITY

David B. Nicholls and **Tom McGibbon**, *Data and Analysis Center for Software*

Cost savings from the use of Software Process Improvement (SPI) techniques may provide a justification for developing higher reliability software.

- 9A2 **AN APPROACH FOR UNDERSTANDING AND TESTING THIRD PARTY SOFTWARE COMPONENTS**
Jennifer M. Haddox, C C Michael, *Cigital* and Gregory M. Kapfhammer, *Allegheny College*
Using “software wrapping”, developers can apply testing techniques such as fault injection, data collection, and assertion checking to third party software components whose source code is unavailable.
- 9A2 **RELIABILITY-CENTERED SOFTWARE TESTING**
Zigmund M. Bluyband, *Advanced Logistics Development Ltd.*
Provides guidelines for the use of Reliability Centered Software Testing for analysis, planning, and control of the test factors affecting software reliability.
- 9A3 **UTILITY OF POPULAR SOFTWARE DEFECT MODELS**
Patrick J. Hartman, *Naval Sea Systems Command*
This paper introduces techniques and rules-of-thumb for critically assessing the effectiveness of software defect reduction efforts as the data are being gathered.
- 9A4 **VALIDATION OF GUIDANCE CONTROL SOFTWARE REQUIREMENTS SPECIFICATION FOR RELIABILITY AND FAULT-TOLERANCE**
Frederick T. Sheldon and Hye Yeon Kim, *Washington State University*
In this case study, the integrity of a software requirements specification for guidance control software is validated in terms of reliability and fault-tolerance.

Session 9B (Linked to Tutorial 8A)

Grand II

ACCELERATED LIFE TESTING

Moderator: Pantelis Vassiliou, *ReliaSoft Corp.*

Today’s consumer driven market demands high reliability in order to stay competitive. ALT is a necessary tool for estimating the reliability of products that demand high reliability. This session presents techniques and applications in this vital area of reliability.

- 9B1 **ACCELERATED TESTS TO SIMULATE METAL-MIGRATION IN HYBRID CIRCUITS**
Satish Bhakta, Gary Mortensen, Tim Muotka, and Scott Lundberg, *Itron, Inc.*
Using the dominant root cause for Ag migration, the authors simulate the effects of contaminants on circuit boards using coupon testing; substantiate the results using Temperature, Humidity, Bias tests; and use the data to increase product reliability.
- 9B2 **RELIABILITY QUANTIFICATION OF INDUCTION MOTORS — ACCELERATED DEGRADATION TESTING APPROACH**
Wendai Wang and Dan Dragomir-Daescu, *General Electric Corporate R&D Center*
The authors propose a new method for planning constant stress accelerated life test. A numerical example is used to demonstrate the approach.
- 9B3 **RELIABILITY STRESS-TEST METHOD: IMPACT ON THE NEW-PRODUCT INTRODUCTION PROCESS, TIME TO MARKET**
Shams Jawaid, *Big Bear Networks*, Seifi Zaki and Jon Ferguson, *Harmonic Inc.*
This paper investigates how to incorporate a comprehensive stress test program for new product introductions.
- 9B4 **PLANNING MULTIPLE-LEVELS CONSTANT-STRESS ACCELERATED LIFE TESTS**
Loon Ching Tang and Min Xie, *National University of Singapore*
A time to degradation model is constructed using the physics of failure and test observations for induction motors. This model is then used to predict the reliability of induction motors.
- 9B5 **MODELING AND ANALYSIS OF TIME-DEPENDENT STRESS ACCELERATED LIFE DATA**
Adamantios Mettas and Pantelis Vassiliou, *ReliaSoft Corp.*
This paper investigates the use of the Cumulative Damage model for analyzing data where the applied stress is time-dependent and its use for making reliability predictions in cases where the service stress is time-dependent even if the test stress is not.

Tutorial 9C (Linked to Paper Sessions 4D & 11C)

Special Topic

Cascade II

MODELING OF REALISTIC SYSTEMS USING THE MONTE CARLO METHOD

Dr. Arie Dubi, *Ben Gurion University of the Negev*

The problem of predicting future behavior of a system is approached rigorously through the use of a single equation. It is then shown that this equation, although extremely complex, is easily approached by the Monte-Carlo method. Some basic concepts of the MC method will be presented and demonstrated.

Session 9D (Linked to Workshops 3D & 4D, & Tutorial 8B)

Cascade I

APPLICATION OF SOFTWARE TOOLS TO R&M ANALYSIS

Moderator: Keith M. Janasak, *Raytheon*

Emerging R&M software tools offer opportunities for more effective management and utilization of R&M information. This session addresses how R&M data can be more effectively utilized to perform R&M analyses such as Knowledge Management, Design for Reliability, Probabilistic Risk Assessment, Failure Modes & Effects Analysis, Reliability Centered Maintenance and Sneak Circuit Analysis.

- 9D1 **QRAS - THE QUANTITATIVE RISK ASSESSMENT SYSTEM**
Frank J. Groen, Carol Sophie Smidts, and Ali Mosleh, *University of Maryland*, and S. Swaminathan, *Sun Microsystems Inc.*
Describes how NASA used the QRAS tool to implement a hierarchical approach for the construction and analysis of risk models

- 9D2 **EFFECTIVE AUTOMATED SNEAK CIRCUIT ANALYSIS**
Christopher John Price, *University of Wales*, and **Nigel Hughes**, *FirstEarth Limited*
Addresses how a tool called SneakExplorer can be used to overcome difficulty of component modeling and generation of false sneaks while performing SCA.
- 9D3 **THE APPLICATION OF RODON TO THE FMEA OF A MICROGRAVITY FACILITY SUBSYSTEM**
Edward J. Zampino, *NASA Glenn Research Center*, and **Dirk Burow**, *R.O.S.E. Informatik*
A NASA application is used to show how a model based reasoning tool can be applied to perform FMEA by implementing a constraint propagation approach.
- 9D4 **PLAUSIBLE REASONING THEORY IN RCM ANALYSIS**
Donald C. Johnston, *United Space Alliance*
Describes how Plausible Reasoning can extend traditional Reliability Centered Maintenance approaches to determine the best mix of maintenance tactics by using inductive and analogous reasoning.
- 9D5 **ENHANCING PRODUCT RELIABILITY USING REMM**
Jane Marshall, *TRW Aeronautical Systems*, **Lesley Walls**, *The University of Strathclyde*, and **Jeffery A. Jones**, *University of Warwick*
Reliability Enhancement Methodology & Modeling is a structured approach for Design For Reliability that leverages reliability information reuse. An expert system recommends a Reliability Task List based on incremental design differences.
- 9D6 **INTELLECTUAL CAPITAL: USING THE WEB FOR KNOWLEDGE MANAGEMENT AND DATA UTILIZATION IN RELIABILITY ENGINEERING**
Adamantios Mettas and **David Rock**, *ReliaSoft Corporation*
Explores how the web can be used for Knowledge Management, combining customer support data, R&D databases, FRACAS data, and a metrics dashboard.

1:30 PM — 3:30 PM

Panel 10A (Linked to Paper Session 5B)

Grand I

INTERNATIONAL SPACE STATION SAFETY AND MISSION ASSURANCE PERFORMANCE METRICS PANEL

Jerry B. Holsomback, *NASA Johnson Space Center*

Panelists will present and discuss Safety and Mission Assurance (SMA) performance metrics used for efficient program management. These metrics combine Safety Hazard Analysis, Reliability Assessments, and Quality Escapes to provide a total health picture on the Space Station at each stage of assembly.

Panelists:

Stanford LeBlanc, *Reliability and Maintainability Manager, International Space Station Program Office, NASA-Johnson Space Center*
Jeevan S. Perera, PhD, JD, *Risk Manager, Institution: Johnson Space Center*

Tutorial 10B (Linked to Tutorial 4B & Paper Session 6B)

Intermediate

Grand II

FAULT TREE ANALYSIS OF COMPUTER BASED SYSTEMS

Dr. Joanne Bechta Dugan, *University of Virginia*

Fault tree analysis has long been a staple of the reliability and safety assessment processes. This tutorial reviews recent advances in fault tree analysis, including coverage models and sequence dependencies that extend its applicability to computer-based systems.

Session 10C (Linked to Tutorials 1D & 9C)

Cascade II

MODELING & SIMULATION

Moderator: Kenneth E. Murphy, *ARINC*

Modeling and simulation tools provide capabilities that should be in every engineer's toolkit. Modeling and simulation allow quantification of impacts, and assessment of system reliability, availability and maintainability characteristics before physical prototypes are built.

- 10C1 **RESEARCH ON THE MODEL AND SOFTWARE-PACKAGE FOR SHIP RELIABILITY ANALYSIS**
Hong Yi, Yufang Zhang, and **Changchun Li**, *Shanghai Jiao Tong University*, and **Mingjun Chen**, *Wai Gaiqiao Ship Building Company*
Using multistage numerical calculations to describe mission reliability and operational readiness.
- 10C2 **RELIABILITY THERMAL ANALYSIS AND OPTIMIZATION WIRABILITY DESIGN OF MULTI-LAYER PRINTED WIRE BOARDS**
Xijin Tian and **Olgiard A. Palusinski**, *The University of Arizona*
Improving electronic component design through a better understanding of thermal impacts.
- 10C3 **INTEGRATED MODELING OF SYSTEM FUNCTIONAL, MAINTENANCE & ENVIRONMENTAL FACTORS**
Jeffery A. Jones, Les Warrington, and **Neil Davis**, *University of Warwick*
Exploring systems functions through a total scenario simulation.
- 10C4 **MULTI-PHASE RELIABILITY ANALYSIS FOR DYNAMIC & STATIC PHASES**
Leila Meshkat, *University of Southern California*, **Yong Ou** and **Joanne Bechta Dugan**, *University of Virginia*
A methodology for combining analyses of phases and understanding their dependencies.
- 10C5 **AVAILABILITY MODELING FOR THE APPLICATION OF MANUFACTURING EQUIPMENT**
Aron Brall, *Landis Gardner*
Unique approach to modeling that can assure improvements in production and reliability.

WEDNESDAY SCHEDULE CONT'D

Session 10D (Linked to Tutorials 1D & 3C) PRODUCT DESIGN & ASSURANCE

Cascade I

Moderator: Jason W. Rupe, *Qwest Communications Int'l*

The application of models, tools, and reliability analyses to improve design and assurance.

- 10D1 **IMPROVING DESIGN FOR RELIABILITY WITH IN-SERVICE DATA ANALYSIS**
Ian James and **Jane Marshall**, *TRW Aeronautical Systems*, and **Lesley Walls**, *The University of Strathclyde*
REMM (Reliability Enhancement Methodology and Modeling), funded by the UK government and aerospace industry, provides some simple reliability analysis techniques that may be used by engineers during the early stages of their design.
- 10D2 **RELIABILITY OF LEAD-FREE SOLDER INTERCONNECTS: A REVIEW**
Sandeep Tonapi and **K. Srihari**, and **Peter Borgesen**, *Universal Instruments Corporation*
This paper discusses reliability issues associated with the use of lead-free solder interconnects, which is becoming more common for environmental and other reasons.
- 10D3 **THE USE OF INDIRECT EVIDENCE FOR BAYESIAN RELIABILITY ANALYSIS**
James Chow Lin, *EQE International*
Indirect evidence can be used in the Bayesian reliability analysis of automobile products during the design phase, when no field performance data are available.
- 10D4 **PREDICT: A CASE STUDY, USING FUZZY LOGIC**
William J. Kerscher III, *Delphi Automotive Systems*, and **Jane M. Booker**, **Mary A. Meyer**, and **Ronald E. Smith**, *Los Alamos National Laboratory*
A case study of the application of PREDICT, which uses Bayesian principles to characterize the reliability of a product under development, including the use of fuzzy logic.

3:45 PM — 5:45 PM

Panel 11A ADVISORY BOARD PANEL THE FUTURE OF RELIABILITY ENGINEERING AS A PROFESSION

Grand I

Moderator: John R. English, *University of Arkansas*

Industry leaders will discuss a topic of interest to members of the reliability and maintainability profession. Audience participation will be encouraged during the session and questions will be welcomed.

Panelists:

C.S. Carlson, *Manager, Reliability Engineering, Mid-Size Car Division, General Motors Corporation*
F.D. Gregory, *Associate Administrator, Safety & Mission Assurance, National Aeronautics & Space Administration*
Dr. Kailash C. Kapur, *Professor, Department of Industrial Engineering, University of Washington, Seattle*
T. Mitrou, *Director, Product Reliability, Black and Decker, Inc.*
G.A. Vassiliades, *Vice-President, Business Reengineering, Division - Server Group, IBM Corp.*

Session 11C (Linked to Tutorial 1A) RELIABILITY MODELING OF SYSTEMS

Cascade II

Moderator: Randall L. Riddle, *U.S. Air Force*

Modeling techniques and application in forecasting and approximating reliability of systems.

- 11C1 **DESIGN & EVALUATION OF AVTMR (ALL VOTING TRIPLE MODULAR REDUNDANCY) SYSTEM**
Hyun-Ki Kim, **Suk Kuin Shin**, **Yong Woon Chung**, and **Key Seo Lee**, *University of Kwangwoon*
Presents an active redundancy systems approach.
- 11C2 **FAULT-INFORMATION MODEL AND MAINTENANCE CYCLE FORECASTING FOR SHIP'S POWER SYSTEM**
Wei Gu and **Jianxing Chu**, *Shanghai Maritime University*
Practical method for estimating the reliability and calculates maintenance cycles.
- 11C3 **RELIABILITY/AVAILABILITY OF K-OUT-OF-N:G SYSTEM WITH M COLD-STANDBY UNITS**
Wendai Wang and **James Loman**, *General Electric Corporate R&D*
Describes a useful method of improving power generation capacity given high reliable systems.
- 11C4 **RELIABILITY EVALUATION OF LARGE COMPLEX REPAIRABLE SYSTEMS: AVAILABILITY OF CRITICAL POWER**
James Loman and **Wendai Wang**, *General Electric Corporate R&D*
Use of reliability block diagramming and simulation to enhance system availability.
- 11C5 **APPROXIMATION METHOD AND FORMULAS FOR AVERAGE UNAVAILABILITY OF SYSTEMS WITH LATENT FAULTS**
Anapathur V. Ramesh, **David W. Twigg**, and **Tilak C. Sharma**, *The Boeing Company*
An interesting perspective on highly reliable systems and components and predicting failures.

WEDNESDAY SCHEDULE CONT'D

Session 11D

Cascade I

TL9000 SESSION SPONSORED BY ASQ

Moderator: David C. Davis, SAIC

The application of TLQ requirements and techniques may have far reaching impact in improving quality and reliability of telecommunication systems.

11D1 **USING TL 9000 MEASUREMENT REQUIREMENTS, MEASUREMENTS, AND FIELD-EXPERIENCE TO IMPROVE QUALITY AND RELIABILITY**

Sandford Liebesman, *Consultant*, and **Thomas F. Yohe**, *Alcatel USA*
Appling measures to drive continuous improvement.

11D2 **TL 9000 MEASUREMENTS: COMPUTATION AND USE**

Aridaman K. Jain, *Lucent Technologies*
Innovative approach to transforming measures and improving reliability.

11D3 **USING TL 9000 MEASUREMENTS**

Richard F. Morrow, *University of Texas*, and **Ashok V. Dandekar**, *Fujitsu Network Communications, Inc.*
Simplifying standards for product improvement.

11D4 **ISO 9000: 2000 - THE CHALLENGES AND OPPORTUNITIES FOR INTERNAL AUDITORS**

Sandford Liebesman, *Consultant*
Opportunities for improvement in quality management.

6:30 PM — 7:30 PM

GENERAL RECEPTION

Grand Foyer

7:30 PM — 10:00 PM

BANQUET

Grand I & II

THURSDAY SCHEDULE

8:00 AM — 10:00 AM

Tutorial 12A FUZZY LOGIC

Special Topic

Grand I

Dr. John Bowles, *University of South Carolina*

Fuzzy logic provides a tool for characterizing and analyzing system reliability in spite of the uncertainties inherent in engineering design.

Session 12B

Grand II

QUALITY & PRODUCT ASSURANCE

Moderator: Dr. Ralph L. Harper Jr., *Raytheon Technical Service Company*

Application of assurance techniques to product development and production can reduce time-to-market, control warranty related costs, and help to meet customer expectations.

12B1 **QFD IMPLEMENTATION IN A DISCRETE-SEMICONDUCTOR INDUSTRY**

Cher Ming Tan and **Teck Khim Neo**, *Nanyang Technological University*
Methods of integration of customer voices in the cost process for manufacturers and vendors.

12B2 **WARRANTY, PRODUCT SPECTRUM, AND CUSTOMER ROLE**

Melkote K. Ramaswamy, *Hurco Companies Inc.*
Scope, meaning, and implementation of warranty on product cost.

12B3 **ANALYZING FUZZINESS IN PRODUCT QUALITY & RELIABILITY INFORMATION-FLOW DURING TIME-DRIVEN PRODUCT-DEVELOPMENT**

Yuan Lu and **Aarnout C. Brombacher**, *Eindhoven University of Technology*, **Elke Den Ouden**, *Philips CFT*, and **Nagappan Ganesh**, *Philips Optical Storage*
Quality and reliability problem prediction in time-driven product development process.

12B4 **RELIABILITY MODELS OF REPAIRABLE SYSTEMS, CONSIDERING THE EFFECT OF OPERATION CONDITIONS**

P.V.N. Prasad and **Kancharla R.M. Rao**, *Osmania University*
Hazard modeling in investigation of the effects of variables on life periods.

12B5 **MEASURING RELIABILITY-CENTERED-MAINTENANCE IMPLEMENTATION**

Donald C. Johnston, *United Space Alliance*
Implementing a Reliability-Centered Maintenance (RCM) program in an organization.

THURSDAY SCHEDULE CONT'D

Session 12C (Linked to Tutorial 1A)

Cascade II

RELIABILITY PREDICTION METHODS

Moderator: David W. Coit, *Rutgers University*

Authors describe a variety of novel approaches and models for predicting and assessing system reliability.

- 12C1 **A FAILURE-FORECAST METHOD BASED ON WEIBULL AND STATISTICAL-PATTERN ANALYSIS**
Kevin Fitzgibbon, Ron Barker, Tige Claton, and Nathan Wilson, Total Quality Systems Inc.
This paper presents a method that combines Weibull analysis and statistical algorithms to forecast failures, and the experimental results are applied to electronic systems.
- 12C2 **FAULT-FREQUENCY PREDICTION OF CHASSIS COMPONENTS FOR HEAVY-DUTY TRUCKS**
Gunnar L. J. Wickstrom, Volvo Truck Corporation
This paper describes a routine for prediction of fault frequency in the product development process of heavy duty trucks at the Volvo Truck Corporation.
- 12C3 **RELIABILITY PREDICTION BASED ON SIMILARITY ANALYSIS**
Tyrone Jackson, The Aerospace Corporation, and Aridaman K. Jain, Lucent Technologies
This paper introduces an 8 step approach for applying Criticality-Associated Similarity analysis in a systematic manner that yields a meaningful comparison of the differences in the design reliability of new product versus a similar in-service product.
- 12C4 **RELIABILITY ASSESSMENT METHODOLOGY FOR 1-SHOT SYSTEMS**
Rene L. Bierbaum and Donald L. Wright, Sandia National Laboratories
This paper outlines some of the challenges of 1-shot device analysis and describes an approach used for the analysis of nuclear weapons.
- 12C5 **HOW DO I GET RAW FAILURE-DATA TO THE SYSTEM RELIABILITY?**
Pozsgai Peter, Anna Krolo and Bernd Bertsche, University of Stuttgart, and Andreas Fritz, DaimlerChrysler AG
Several methods for calculating system reliability are investigated when preventive maintenance actions are considered. A case study of a single-step gearing is presented to illustrate the methodology.

Session 12D

Cascade I

R&M TECHNIQUES AND APPLICATIONS

Moderator: Gary S. Wasserman, *Wayne State University*

Cost consciousness and the quickened pace of the product development cycle rarely permit leisurely or overly elaborate analysis. Practical and convenient methods for providing R&M estimates are discussed.

- 12D1 **THE EXPONENTIAL DISTRIBUTION: THE GOOD, THE BAD AND THE UGLY. A PRACTICAL GUIDE TO ITS IMPLEMENTATION**
Kenneth E. Murphy, Charles M. Carter, and Steven O. Brown, ARINC
This paper provides insight into the good aspects of using the exponential distribution but more importantly, into the ubiquitous misuse of the most commonly implemented reliability distribution.
- 12D2 **A SIMPLIFIED RELIABILITY-ANALYSIS TOOL FOR REDUNDANT HARDWARE & SOFTWARE SYSTEMS**
Wei Hou, Sun Microsystems and O. Geoffrey Okogbaa, University of South Florida
This paper proposes a simplified computational tool that incorporates Markov analysis and reliability block diagrams to model and analyze the availability of a typical end-to-end communication solution with 1:1 system redundancy.
- 12D3 **COMPARISON OF RELIABILITY & AVAILABILITY EVALUSTION TECHNIQUES FOR DISTRIBUTION NETWORK SYSTEMS**
Emiliano Roggero, Alessandra Mosso and Andrea Ponta, A.E.M. Torino S.p.A., and Enrico Carpaneto, Politecnico di Torino
Different methods of reliability evaluation for medium voltage distribution systems (MVDS) are compared.
- 12D4 **PROBABILISTIC ASSESSMENT OF AVAILABILITY FROM SYSTEM PERFORMANCE DATA**
Jan B. Smith and W. Bryan Smith, Applied Reliability, Inc.
This paper presents a new method for forecasting availability and reliability distributions from permutations of system data and conversion of the probability data to business and engineering decision information.
- 12D5 **APPLICATION OF BAYES STATISTICS TO REDUCE SAMPLE-SIZE, CONSIDERING A LIFETIME-RATIO**
Anna Krolo, Bettina Rzepka, and Bernd Bertsche, University of Stuttgart
Bayesian statistics can determine the optimal duration of planned reliability testing using a lifetime-ratio and previous knowledge obtained from prior tests.
- 12D6 **APPLICATION OF SEMI-MARKOV PROCESS AND CTMC TO EVALUATION OF UPS SYSTEM AVAILABILITY**
Ricardo M. Fricks, Motorola, Inc., Liang Yin and Kishor S. Trivedi, Duke University
The authors use a semi-Markov model and a continuous-time Markov chain (CTMC) approach to assess the dependability characteristics of systems with uninterruptible power supplies.

Workshop 12E

Grand Crescent

ASQ CERTIFIED RELIABILITY ENGINEER (CRE) EXAM

The exam will last 4 hours and consists of 150 questions. Registration closes at 4:00 PM on Wednesday. The 8 areas of the Body of Knowledge are covered in detail, be sure to study all and attend the review sessions on Tuesday. Calculators are suggested; only non-programmable ones are permitted. Order a CRE Refresher Booklet from ASQ at 1-800-248-1946.

THURSDAY SCHEDULE CONT'D
10:15 AM — 12:15 PM

Tutorial 13A (Linked to Paper Sessions 7C & 9A)

Intermediate

Grand I

INTRODUCTION TO SOFTWARE RELIABILITY RISK MANAGEMENT

Norman F. Schneidewind, *Naval Postgraduate School*

This tutorial is designed for practitioner software engineers and managers who want to learn how to apply software reliability risk management in their organizations. Attendees will learn how to apply a software reliability risk analysis to identify fault prone software.

Panel 13B

Grand II

WHY IS THERE STILL INFANT MORTALITY?

Moderator: James A. McLinn, *Consultant*

Invited panelists will discuss prevention and effects of infant mortality on product manufacturing, delivery and field performance. Despite 20 years of improvement efforts, SPC, DOE and other tools, infant mortality beyond reasonable levels for many products still exists. Come hear what are causes and then what are effective and economical solutions.

Panelists:

Dr. James Loman, *General Electric Corporate R&D*

James A. McLinn, *Rel-Tech*

Dr. Feng-Bin Sun, *Maxtor Corporation*

Session 13C

Cascade II

R&M IN AEROSPACE

Moderator: Bonnie S. Hauge, *United Space Alliance*

A range of Reliability and Maintainability applications for aerospace, from satellite repair and spacecraft failure prediction to aircraft failure prediction effects of latent failures.

13C1 A RELIABILITY-DRIVEN MISSION FOR SPACE STATION

Martin L. Shooman, *Hunter College, CUNY*, and **Pasquale M. Sforza**, *University of Florida*

A proposal to use the International Space Station as a repair base for the many communications, scientific, and military satellites in Lower Earth Orbit, and that the Space Shuttle be used to retrieve such satellites.

13C2 THE KNOWLEDGE-PATH TO MISSION SUCCESS: OVERVIEW OF THE NASA PBMA-KMS

J. Steven Newman and **Stephen M. Wander**, *NASA Headquarters*

A description of a Process Based Mission Assurance Knowledge Management System developed by NASA to support life-cycle safety and mission success management in a performance based contracting environment.

13C3 PARAMETRIC PREDICTION TOOLS FOR SPACECRAFT CONCEPTS

Nkiru Udo Ogamba, *The Aerospace Corp*

This paper demonstrates several analytical techniques used to predict units from a group more likely to fail. It specifically examines the least reliable systems used by a number of US spacecraft programs.

13C4 DYNAMIC MODELING OF DEGRADATION DATA

Ming-Xiao Jiang, *General Electric*, and **Yongchang Zhang**, *Eaton Corp.*

For applications with few or no failures degradation data can be used to provide reliability information. In this paper a dynamic model using random fatigue crack growth as an example is presented.

13C5 A DISCRETE-EVENT SIMULATOR FOR PREDICTING OUTAGE TIME & COSTS AS A FUNCTION OF MAINTENANCE RESOURCES

Myron Hecht, *SoHaR Inc.*, and **Jady Handal**, *Federal Aviation Administration*

Presentation of a simulation tool (SMART-3) for airport maintenance managers to minimize downtime and maximize resource utilization.

Session 13D (Linked to Tutorials 2D, 5C & 8A)

Cascade I

ENVIRONMENTAL TESTING AND STRESS SCREENING

Moderator: Dr. Ralph L. Harper Jr., *Raytheon Technical Service Company*

Evaluates methods used to test and screen various products for impacts caused by environmental conditions.

13D1 RELIABILITY TESTS ON IGBT

Santiago Fernandez-Gomez, *ATI Research Silicon Valley*, and **Jorge Marcos Acevedo**, *University of Vigo*

The design of dependable systems based on reliable power devices using reliability tests.

13D2 RELIABILITY PARTS IMPROVEMENT OF PLASTIC PARTS

A. J. Morrison, *Alliant Tech Systems*

Environmental Stress Screening (ESS) or testing cycles for qualification on first articles.

13D3 ELECTRONIC PACKAGING ADHESIVE FATIGUE-LIFE PREDICTION USING THERMAL-CYCLING STEP-STRESS TESTING

Xijin Tian and **John L. Prince**, *University of Arizona*

Epoxy adhesives failures in electronic packaging due to thermomechanical.

13D4 ESTABLISHMENT OF ACCELERATED CORROSION-TESTING CONDITIONS

Lev M. Klyatis, *Eccol Inc.*

Atmospheric Corrosion Testing (ACT) of metals.

13D5 IMPROVING THE RELIABILITY OF A NEWLY-DESIGNED MOBILE PHONE BY ENVIRONMENTAL & ACCELERATED LIFE TESTS

Sang Jun Park, **Jong Shin Ha**, **Wan Soo Choi**, and **Sang Duck Park**, *Samsung Electronics Co., Ltd.*

Reliability evaluation of components of a mobile phone.

RAMS DISCIPLINE TRACKS

While all sessions will contain elements of interest for the majority of participants, special disciplines are emphasized in individual sessions. If your profession tends to specialize in the areas listed in the first column below, we recommend you attend the sessions listed opposite your specialty.

PARTICIPANT SPECIALTY	MONDAY			TUESDAY				WEDNESDAY				THURSDAY	
	8:00 - 10:00 AM	10:15 - 12:15 PM	2:30 - 5:00 PM	8:00 - 10:00 AM	10:15 - 12:15 PM	1:30 - 3:30 PM	3:45 - 5:45 PM	8:00 - 10:00 AM	10:15 - 12:15 PM	1:30 - 3:30 PM	3:45 - 5:45 PM	8:00 - 10:00 AM	10:15 - 12:15 PM
Education	All	All	All	All	All	All	All	All	All	All	All	All	All
Computer Aided Engineering			3D		5D				9D				
Design/Development	1C or 1D			4A		6A		8C	9B or 9C	10C or 10D	11C	12B, 12C or 12D	13B
Logistics		2B		4C or 4D		6C	7A			10C	11C	12C	13 A, 13B or 13C
Maintainability	1B	2B		4D	5A	6D	7B				11C	12B or 12B	13B, 13C or 13D
Maintenance	1B	2B		4C	5A	6C or 6D	7B	8C		10C	11C		13D
Management	1C	2B	3A	4C	5B	6A or 6C	7B				11C or 11D		13D
Product Quality		2D	3C	4D	5A				9A or 9B	10A	11C or 11D	12B	13B or 13D
Reliability	1A or 1D	2C or 2D		4A or 4D	5C	6C	7B or 7D	8A, 8B or 8C	9B or 9C	10A, 10C or 10D	11C	12B, 12C or 12D	13B or 13D
Safety				4B		6B or 6C				10A or 10B			
Software							7C		9A	10A			13A
Statistics & Probability	1A	2A	3C	4D			7A		9B	10D		12A or 12D	13D
Systems Engineering		2C		4A or 4D	5A or 5B	6B or 6C	7A or 7 D	8B or 8C		10C	11C or 11D	12B or 12C	13B or 13C
Test and Evaluation				4B or 4D		6C			9A or 9B	10B			13D

Call For Papers & Tutorials

Year 2003 International Symposium on Product Quality and Integrity Reliability and Maintainability Symposium (RAMS)

If you wish to present a paper or tutorial at the Year 2003 International Symposium on Product Quality and Integrity — Reliability and Maintainability Symposium (RAMS) at the Tampa Waterside Marriott, Tampa, FL USA on January 27 - 30, 2003, you must submit an abstract of your paper or tutorial prior to April 15, 2002.

The abstract must follow the format as specified in the Call For Papers & Tutorials. The Call For Papers & Tutorials is printed in the 2002 Symposium Proceedings, and will be mailed to sponsoring society members and prior attendees to this Symposium. Copies of the Call For Papers & Tutorials or additional information may be obtained by contacting:

RAMS Database Coordinator
c/o IPS Group, Inc.
4405 Tarpon Lane
Alexandria, VA 22309-3136 USA
1-703-360-0480
e-mail: webmaster@rams.org

Again, the deadline for receiving the abstract is April 15, 2002 and the abstract must follow the format as specified in the Call For Papers. The full Call For Papers is included in your registration packet and can be accessed on the world wide web at <http://www.rams.org>.

Publications From This & Previous Symposia

Copies of all listed publications shown on the right are available from:

Annual Reliability & Maintainability Symposium
c/o Scien-Tech Associates, Inc.
P.O. Box 2097
Banner Elk, NC 28604-2097 USA
1-828-898-6375
dbarbsta@aol.com

Year and Price

Each year has a separate Proceedings and Tutorial Notes.
(Publications not listed here are not available.)

Proceedings (1 book for each year)	
1973, 1975, 1976, 1977, 1978, 1981, 1982	\$24 each
1984, 1985, 1986, 1987, 1988, 1989	\$40 each
1990, 1991, 1992, 1993, 1994, 1995	\$50 each
1996, 1997, 1998, 1999, 2000, 2001, 2002	\$50 each
Tutorial Notes (1 book for each year)	
1991, 1992, 1993, 1994, 1995, 1996	\$40 each
1997, 1998, 1999, 2000, 2001, 2002	\$55 each

Payment in US currency, credit card, or check (displaying US banking system transit number) MUST accompany your order. Make checks payable to "Reliability and Maintainability Symposium" or "RAMS". Please note, there may be additional charges for delivery to International addresses. Contact, Scien-Tech Associates, Inc., to see if these additional fees apply. Prices within the USA include postage by slow surface mail. Show exact mailing address in form suitable for address label, including country, if not USA.

RAMS Advisory Board Panel Questionnaire

Wednesday, January 30, 3:45 - 5:45 PM

THE FUTURE OF RELIABILITY ENGINEERING AS A PROFESSION

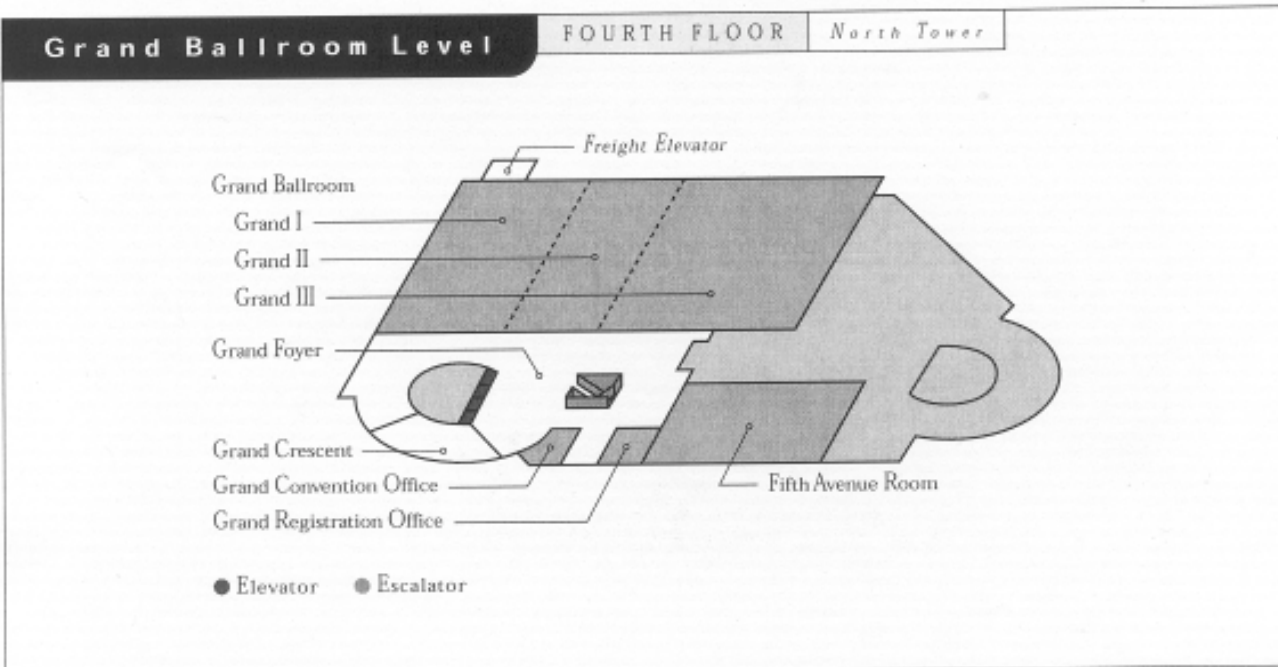
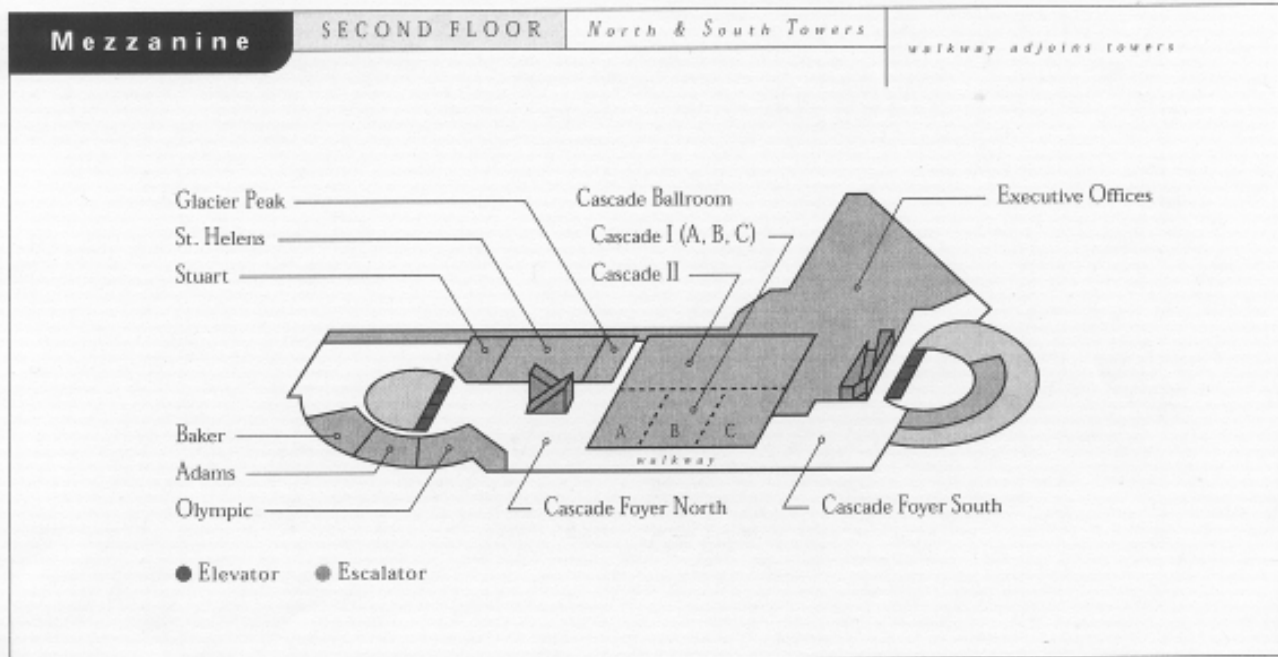
The RAMS Advisory Board is made up of highly successful reliability professionals that fill high-level positions within aerospace, commercial, defense, R&D, and the academic communities. The board provides critical direction to the RAMS organization, as the future becomes our reality. Each year, this distinguished board serves as a panel at RAMS.

This year's advisory panel will prove to be enlightening to all reliability, availability, maintainability and safety professionals. With downsizing and streamlining, many organizations are eliminating quality and reliability staff, or in many cases, they are integrating these functions into other positions. As a result, this year's topic, "*The Future of Reliability Engineering as a Profession*," will be of interest to all professionals in the areas of reliability, availability, maintainability and safety. Please mark your RAMS program on Wednesday for this significant event.

This outstanding panel will be available for your questions during the session. If you have a question or a concern for an Advisory Board Panel member or for discussion by the Panel as a whole, please fill in this form and deposit it at the RAMS Registration Desk no later than 4:00 P.M., Tuesday, January 29.

Name and Affiliation (Optional)

Floor plan of the Seattle Westin Hotel



MANAGEMENT COMMITTEE

GENERAL CHAIRPERSON — L.M. Rabon, Jr., DoD PM-MEP

Vice General Chairperson — J.R. English, *University of Arkansas*

Secretary

W.J. Osborne, *Bill Osborne Consulting*

Treasurer/Advance Registration

R.W. Sears, Jr., *Retired*

PROGRAM COMMITTEE

CHAIRPERSON

C.N. Butler, *Lockheed Martin Aeronautics Co.*

Vice Chairpersons

R.L. Harper, Jr., *Raytheon Technical Service Co.*

W.P. Murdock, Jr., *AFRL/HEST*

D. Oberhettinger, *Northrup Grumman*

E.A. Pohl, *United States Military Academy*

A.M. Stevens, *United Space Alliance*

L.H. Wolfe, *SAIC*

J.D. Healy, *Telcordia Technologies*

J.B. Bowles, *University of South Carolina*

H.A. Chan, *San Jose State University*

C. Smith, *James Madison University*

K. Janasak, *Raytheon Company*

PUBLICITY COMMITTEE

CHAIRPERSON

V.W. Wessel, *NASA Glenn Research Center*

Vice Chairpersons

C.R. Cassady, *University of Arkansas*

J. Durand, *Alstom Transportation, Inc.*

R.B. Jones, *Enron Energy Services*

J. Rupe, *Qwest Modeling & Optimization*

ARRANGEMENTS COMMITTEE

CHAIRPERSON

R.M. Adib, *P&W Space Propulsion*

Vice Chairpersons

J.R. Bedwell, *Visteon Automotive Systems*

A. Brall, *Landis Gardner, a UNOVA Company*

D.M. Deans, *The Dow Chemical Co.*

P.S. Sackett, *Hospitality Consultant*

REGISTRATION COMMITTEE

CHAIRPERSON

L.J. Jackson, *US Army CECOM*

Advance Registration

R.W. Sears, Jr., *Retired*

Vice Chairpersons

J.R. Fragola, *SAIC*

J.A. McLinn, *Rel-Tech Group*

D.E. Onalfo, *Pacific Bell*

PUBLICATIONS COMMITTEE

CHAIRPERSON

R.A. Evans, *Q & R Consultant*

J.A. Nachlas, *Virginia Tech.*

EXHIBITION MANAGER

D.F. Barber, Jr., *Scien-Tech Associates, Inc.*

GRAPHICS ARTS MANAGER

W.H. Horner, *Horner's Computer Solutions*

WEBMASTER

J.A. Hess, *IPS Group, Inc.*

ADVISORY BOARD

C.S. Carlson, *Manager, Reliability Engineering,
Mid-Size Car Division, General Motors Corporation*

F.D. Gregory, *Associate Administrator, Safety & Mission Assurance
National Aeronautics & Space Administration*

Dr. Kailash C. Kapur, *Professor, Department of Industrial Engineering,
University of Washington, Seattle*

T. Mitrou, *Director, Product Reliability
Black and Decker, Inc.*

G.A. Vassiliades, *Vice-President, Customer Satisfaction &
Quality, IBM Corp.*

BOARD OF DIRECTORS

CHAIRPERSON — W. Kuo, *Texas A&M University*

Co-Sponsors

American Institute of Aeronautics and Astronautics (AIAA)

W. Robertson, *Dynamics Research Corp.*

K. McKibben, *Consultant*

American Society for Quality — Electronics & Comm. Div. (ASQ/E&CD)

L.H. Tomlinson, *ASQ "Quality Engineering" Journal*

C.W. Plotkin, *Ford Motor Company*

American Society for Quality — Reliability Division (ASQ/RD)

J.A. Miller, *J.A. Miller and Associates, Consulting*

T. Gurunatha, *Xerox Corporation*

Institute of Electrical & Electronics Engrs — Reliability Society (IEEE/RS)

V.R. Monshaw, *Consultant*

T.L. Fagan, *Drexel University*

Institute of Environmental Sciences and Technology (IEST)

L.H. Crow, *IIT Research Institute*

R. Geminder, *Marketing Mgmt & Engr Consultant*

Institute of Industrial Engineers (IIE)

O.G. Okogbaa, *University of South Florida*

R.J. Loomis, *NASA Dryden Flight Research Center*

Society of Automotive Engineers (SAE)

R.J. Rudy, *DaimlerChrysler AG*

W. Jankovsky, *Caterpillar, Inc.*

Society Of Logistics Engineers (SOLE)

D. Verma, *Lockheed-Martin*

M.A. Pinard, *Consultant*

Society of Reliability Engineers (SRE)

C.N. Meese, *US Army PM-Soldier Systems*

System Safety Society (SSS)

D.G. Raheja, *Consultant*

B. Moriarity, *TRW*

Hotel Registration Form - 2002 RAMS

January 28 - 31, 2002

— Form A —

Call, Mail or FAX completed form to:

Seattle Westin Hotel

1900 Fifth Avenue
Seattle, WA 98101 USA
1-206-728-1000
1-800-WESTIN-1
Fax 1-206-727-5896

Rates	<input type="checkbox"/> Single Occupancy	\$159 (U.S.)
	<input type="checkbox"/> Double Occupancy	\$159 (U.S.) *
Room Preference	<input type="checkbox"/> King	<input type="checkbox"/> Double-Double
	<input type="checkbox"/> Smoking	<input type="checkbox"/> Non-smoking
* \$30 per additional person All reservations subject to local sales taxes.		

Name _____	Hotel Arrival _____	Date _____
Organization _____		Time _____
Address _____	Hotel Departure _____	Date _____
City _____ State _____ Country Code _____		Time _____
Business Phone _____	Normal check-in time 3:00 PM	
	Normal check-out time 12:00 Noon	
Credit Card Type _____	Deposit Amount _____	
Credit Card Number _____	Expiration Date _____	
Signature _____		

All reservations must be received by January 5, 2002 and accompanied by a one-night room deposit in the form of a personal check, money order, or an American Express, Visa, or Master Card credit card authorization. **Ask for the special RAMS rate.** One registration form per room please.

Return this form directly to the Hotel — DO NOT INCLUDE WITH RAMS REGISTRATION

2002 RAMS Advance Registration

B

(valid through November 26, 2001 through January 11, 2002 - No Registrations Accepted 1/12/2002 through 1/26/2002)

I have INCLUDED payment to register as: (Check One)		I have INCLUDED payment by: (Check One)	Banquet Choices
<input type="checkbox"/> \$675 NON-MEMBER * <input type="checkbox"/> \$575 MEMBER * <input type="checkbox"/> \$60 FULL-TIME STUDENT † <input type="checkbox"/> \$200 PRESENTING AUTHOR		<input type="checkbox"/> Credit Card <input type="checkbox"/> Check <input type="checkbox"/> Special	<input type="checkbox"/> Not attending <input type="checkbox"/> Beef <input type="checkbox"/> Chicken <input type="checkbox"/> Fish <input type="checkbox"/> Special
I am a member of: (check all that apply)		Membership Number _____	
<input type="checkbox"/> AIAA <input type="checkbox"/> ASQ/E&CD <input type="checkbox"/> ASQ/RD <input type="checkbox"/> IEEE <input type="checkbox"/> IEST <input type="checkbox"/> IIE <input type="checkbox"/> SAE <input type="checkbox"/> SOLE <input type="checkbox"/> SRE <input type="checkbox"/> SSS			

Name																										
(For Badge)	Last	First										MI														
Employer																										
Address																										
City	State/Province																									
Zip/Postal Code	Country																									
Phone	e-mail																									
Credit Card/Check #	Exp.																									
(Credit Card must be in Name of Registrant)																										
Cardholder Signature	Name (Print)																									

**Register on-line at www.rams.org
or mail your completed
Registration form & payment to:**

Dr. Raymond W. Sears, Jr.
23 Fairway Drive
P.O. Box 1407
Graham, NH 03753-1407 USA

Phone 1-603-863-2832
(8 AM - 10 PM Eastern Standard Time)

e-mail: r.w.sears@ieee.org
(For information only)

* Includes banquet, proceedings, tutorial notes, and all paper, panel and tutorial sessions. † Includes proceedings, tutorial notes, and all paper, panel and tutorial sessions.

Payment IN FULL MUST accompany this completed form. Checks in US Dollars displaying US banking system transit number, made payable to RAMS 2002 will be accepted. We also accept VISA, MasterCard, or AMEX. Credit Cards will be charged the full amount upon receipt. Please call to make special payment arrangements. Online registrations will be acknowledged by e-mail. Allow 3 weeks for acknowledgment of mailed registrations. Advanced registrations **MUST** be in our hands by January 11, 2002. No registrations will be accepted January 12 through 26, 2002. There are no limitations on number of attendees wishing to register at the door, but fees are \$100 additional except for students. Advance registrations are **NON-REFUNDABLE** after January 11, 2002.

Dr. Raymond W. Sears, Jr.
23 Fairway Drive
P.O. Box 1407
Grantham, NH 03753-1407 USA

**Reliability AND Maintainability
Symposium (RAMS)**

Sponsored by:

AIAA	ASQ/E&CD	ASQ/RD	IEEE	IEST
IIE	SAE	SOLE	SRE	SSS

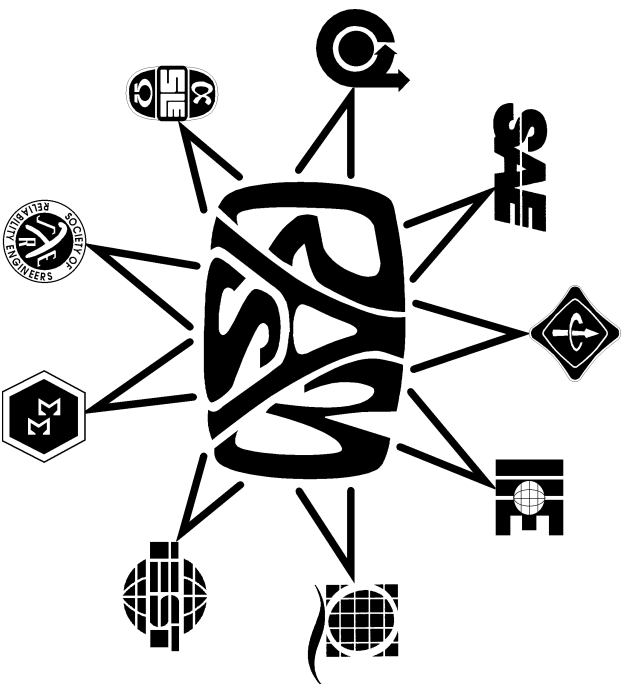
TO:

An Invitation To:

RAMS
The International Symposium
on Product Quality & Integrity

Web: <http://www.rams.org>

OUR 48th YEAR



January 28 - 31, 2002

The Westin Seattle
1900 Fifth Avenue
Seattle, WA 98101 USA

1-206-728-1000
1-800-WESTIN-1

Fax 1-206-727-5896

**IMPROVING PRODUCTS AND
PROCESSES THROUGH EDUCATION**